

VETERINARSKI ARHIV 75 (4), 369-374, 2005

Efficacy of Ivermectin in an injectable formulation against gastrointestinal nematodes of donkeys (*Equus asinus*)

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SERI, H. I., A. D. ABAKAR, A. A. ISMAIL, T. A. TIGANI: Efficacy of Ivermectin in an injectable formulation against gastrointestinal nematodes of donkeys (*Equus asinus*). Vet. arhiv 75,369-374, 2005.

ABSTRACT

The efficacy of Ivermectin was evaluated under field conditions at Nyala town, South Darfur State, Sudan. The study involved 16 donkeys. Ivermectin was administered by intramuscular injection at dose of 0.2 mg/kg in the lateral mid- line of the neck. Treatment efficacy was based on the mean faecal egg count reduction 14 days post treatment. A faecal egg count reduction of 100% was found after treatment with Ivermectin. In addition efficacy percentages of Ivermectin against immature and adult nematodes were as follows: *Trichostrongylus axei* 100%, *Parascaris equorum* 100%, *Oxyuris equi* 100%, *Triodontophorus* sp. 100%, *Strongylus* sp. 100%, and small strongyles 100%. Two of the control donkeys were infected with *Strongylus vulgaris* larvae. Ivermectin showed moderate efficacy (69.23%) against larvae found in the mesenteric artery aneurisms. No adverse reactions were observed during the experimental period.

Key words: Ivermectin, donkeys, gastrointestinal nematodes, efficacy

Introduction

Donkeys are becoming increasingly important animals in the Sudan given the new socio-economic situation with an increased use of donkeys instead of horses in labour and transportation. Nematode infection was the main problem reported in donkeys admitted to veterinary clinics (ALI et al., 2001). Ivermectin "ivomec" is a potent agent, active against

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many external and internal parasites in domestic animals. Ivermectin is today the elixir in the world of parasite chemotherapy. It is vogue and highly effective with a wide margin of activity and safety. In equines, a variety of adverse reactions have been reported in horses after parenteral administration of Ivermectin at the recommended dosage of 0.2 mg/kg body weight (FRENCH et al., 1983; LEANING, 1983; REED, 1983). These reactions have occurred in a small percentage of treated horses and the drug is now sold only as a paste for oral administration. Ivermectin has an excellent efficacy for an important range of gastrointestinal nematodes of equines (CAMPBELL et al., 1989). Although not registered for use in donkeys, Ivermectin injection is currently used by many donkey owners who are claiming excellent results and no adverse side-effects. The aim of this study was to investigate the therapeutic efficacy of Ivermectin introduced intramuscularly as an injectable formulation to donkeys harbouring natural gastrointestinal nematodes.

Materials and methods

Study animals. This study involved 16 donkeys, aging 3-10 years. The donkeys had naturally acquired mixed parasitic infections, comprising gastrointestinal nematodes. Infections were confirmed before the beginning of the study by egg flotation and the parasites were identified after performing larval culture. Individual egg count was determined by using a modified McMaster technique (ANON., 1986). After treatment, experimental animals were penned by treatment groups until the end of the observation period. The animals were kept on tap water and straw ad libitum.

Design of study. Faecal samples were collected from all donkeys and analyzed the same day using a modified McMaster technique with a sensitivity of 50 EPG (egg per gram of faeces). Animals were weighed and treated as follows: Ivermectin – treated group I (IVMT) (14 animals) received a single intramuscular injection of 200 mcg/kg Ivermectin (Ivermectin 10[®] injection, ANUPco. England). Injection was administered in the lateral mid- line of the neck. The remaining two animals were kept untreated as control animals (intended for slaughtering). Donkeys were then observed for possible adverse reactions for 2 hours after injection. Faecal egg counts were performed on each animal daily for the first week and then on days 14, 21 and 28. On each of days 15, 16, 17, and 18 two animals (one per each day) from each group (control and IVMT) were killed and necropsied. Day of slaughter for each animal had been determined on day zero by random assignment at the same time as donkeys were allocated to treatment groups. Animals were slaughtered and methods used for worm recovery were the same as those previously described by (REINECKE and LE ROUX, 1972). Helminthes were identified at a later stage by placing them on glass slides, examining them microscopically and classifying them using the early description (LICHTENFELS, 1975).

Data analysis. The faecal egg count reduction (FECR) test was used to determine the anthelmintic efficacy. Each animal acted as its own control. Arithmetic means of the egg

counts and nematode burdens were calculated to determine the mean percentage reductions, according to the following formula:

$$\text{FECR}\% = \frac{\text{Pre-treatment EPG} - \text{Post-treatment EPG}}{\text{Pretreatment EPG}} \times 100$$

Results and discussion

Faecal egg count reductions. The results of day zero to day 28 mean EPG values are presented in Table 1, together with the mean faecal egg count reductions. Ivermectin produced 100% reduction of nematode eggs on day 7 onwards. On day 0 all donkeys had positive egg counts with a range of 100-5150 EPG. On day 14, at IVMT all donkeys had negative egg counts to the end of the experiment.

Table. Mean faecal egg counts (\pm SD) and reductions for Ivermectin - treated donkeys

Day	Arithmetic mean (EPG)	Range	Mean% reduction
0	1545.0 \pm 1589.6	100 - 5150	-
1	1270.0 \pm 545.3	650 - 2400	17.80%
2	744.4 \pm 1015.9	0 - 3300	51.82%
3	195.0 \pm 279.3	0 - 800	87.38%
4	20.0 \pm 35.0	0 - 100	98.71%
5	15.0 \pm 24.2	0 - 50	99.03%
6	5.0 \pm 15.8	0 - 500	99.68%
7	0.0 \pm 0.0	0 - 0	100%
14	0.0 \pm 0.0	0 - 0	100%
21	0.0 \pm 0.0	0 - 0	100%
28	0.0 \pm 0.0	0 - 0	100%

Postmortem findings. The results of postmortem findings and the nematodes collected were present in Table 2. The results obtained indicated that animals received Ivermectin intramuscularly showed zero nematode burdens except for the larval stages of *Strongylus vulgaris* larvae (L4) present in the cranial mesenteric artery. In the trunk of the cranial mesenteric artery (and its main branches), in the iliac, celiac, femoral arteries larvae cause inflammation of the arterial wall, formation of thrombuses, thickening and dilatation of the wall of arteries, aneurysms.

Table. Summary of worms recovered from control and treated animals with Ivermectin at necropsy (mean \pm SD)

Organs examined	Control	IVMT	
		No.	Red. %
Cranial mesenteric artery			
<i>Strongylus vulgaris</i>	130	40	69.23
Stomach			
<i>Gastrophilus</i> sp.	667	0	100
<i>Habronema</i> sp.	320	0	100
<i>Trichostrongylus axei</i>	50	0	100
Small Intestine			
<i>Parascaris equorum</i>	10	0	100
Caecum			
<i>Gastrophilus</i> sp.	30	0	100
<i>Strongylus</i> sp.	820	0	100
<i>Cyathostomes</i> sp.	1000	0	100
Colon			
<i>Strongylus</i> sp.	3360	0	100
<i>Cyathostomes</i> sp. + <i>Strongyloides westeri</i> + <i>Oxyuris equi</i>	22500	0	100
Rectum			
<i>Gastrophilus</i> sp.	110	0	100
<i>Oxyuris equi</i>	20	0	100

Discussion

In this study, a 100% reduction in faecal egg count was shown at IVMT animals after administration of Ivermectin by intramuscular injection. This finding is in accordance with other findings in horses (COSTA et al., 1998; DAVIES and SCHWALBACH, 2000). Doramectin, an avermectin currently registered for use in sheep, cattle and swine also produced 100% efficacy when administered to donkeys in Sudan (SERI et al., 2004)., and to horses in South Africa (DAVIES and SCHWALBACH, 2000). These findings indicate that Ivermectin appears to be effective against adult *Cyathostomes*, *Strongylus* spp., *Trichostrongylus axei* and *Parascaris equorum* in donkeys.

In this study, the presence of some *Strongylus vulgaris* larvae in the animals treated with Ivermectin intramuscularly indicated incomplete activity against arterial stages of *Strongylus vulgaris* as Ivermectin showed only (69.23%) efficacy against arterial stages. This result is in agreement with that of (COSTA et al., 1998) who reported (67.8%) efficacy of Ivermectin against *Strongylus vulgaris* larvae found in the mesenteric artery aneurisms. No adverse reactions were observed such as irritation or swelling at the injection site in any of the treated donkeys.

The fact that Ivermectin may be administered by intramuscular injection ensures that no anthelmintic is wasted hence no under dosing occurs, providing the animal weight is accurately determined. Under- dosing has been suggested as an important factor in hastening the development of resistance (PRICHARD, 1990) and this is often a risk associated with oral dosing, as spillage frequently occurs.

Conclusion

A single intramuscular injection of Ivermectin administered at a dose rate of 0.2 mg/kg body weight was highly efficient against naturally acquired infections of adult *Cyathostomes*, *Strongylus* spp., *Trichostrongylus axei*, *Parascaris equorum*, *Oxyuris equi* and *Triodontophorus* spp.; gastrointestinal nematodes in donkeys. These findings suggest that further research into the use of Ivermectin injectable formulation as an equine anthelmintic might be warranted.

Acknowledgments

The generous financial support granted by the German Academic Exchange Service (DAAD) was greatly acknowledged. Due thanks are extended to Dr. Mohammed Ahmed Hassan Ghurashi for help.

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Received: 14 August 2004

Accepted: 28 June 2005

SERI, H. I., A. D. ABAKAR, A. A. ISMAIL, T. A. TIGANI: Djelotvornost ivermektina kao injekcijske otopine protiv želučano-crijevnih oblića magaraca (*Equus asinus*). *Vet. arhiv* 75, 369-374, 2005.

SAŽETAK

Procjenjivana je djelotvornost ivermektina u terenskim uvjetima u gradu Nyala, Južni Darfur, Sudan. Istraživanje je provedeno na 16 magaraca. Ivermektin je bio primijenjen intramuskularnim injekcijama u dozi od 0,2 mg/kg u lateralnu stranu vrata. Ocjena učinkovitosti lijeka provedena je na temelju smanjenja ukupnog broja jaja u fecesu 14 dana poslije liječenja. Ukupni broj jaja u fecesu smanjio se za 100% poslije primjene ivermektina. Nadalje, postotci djelotvornosti ivermektina protiv nezrelih i adultnih stadija oblića bili su: *Trichostrongylus axei* 100%, *Parascaris equorum* 100%, *Oxyuris equi* 100%, *Triodontophorus* sp. 100%, *Strongylus* sp. 100% i mali strongilidi 100%. Dva kontrolna magarca bila su invadirana ličinkama *Strongylus vulgaris*. Ivermektin je bio umjereno djelotvoran (69,23%) protiv ličinki nađenih u aneurizmama mezenterijalnih arterija. Tijekom pokusa nisu zamijećene štetne posljedice liječenja.

Ključne riječi: ivermektin, magarci, želučano-crijevnih oblići, djelotvornost
